PATENT SPECIFICATION 1,056,134

DRAWINGS ATTACHED.

1,056,134

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COMPLETE SPECIFICATION.

Pressure Reducing Valve for Gases Issuing from a Container for Liquid Gas.

We, GURTNER S.A., a French Joint Stock Company, of 44 Rue Laugier, Paris (Seine), France, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention relates to a pressure reducing valve for double expansion of liquid gas, for example butane or propane, issuing from containers or bottles for liquid gas.

According to this invention a pressure reducing valve comprises a body, an outlet for expanded gas, and a connecting socket for fitting to a connecting mouthpiece for a liquid gas source, the mouthpiece having a valve with a closure member urged to the closed position; wherein a pushrod, axially movable in a bore in the socket with clearance to permit liquid gas flow, is fixed at one end to a first membrane closing a first expansion chamber, the length of the pushrod being such that on axial movement its free end can open the closure member of the mouthpiece valve; wherein a second expansion chamber communicates with the outlet and with the first chamber through a passage having a valve urged to closed position by a second membrane in the second chamber under the action of fluid expansion pressure; and wherein an operating lever, rotatably mounted about the axis of the pushrod, operates, by means of a peg and an associated inclined surface, an axially movable supporting member, a spring between the supporting member and the first membrane tending to move the pushrod into the mouthpiece and to move the peg and inclined surface relatively toward one another, one of the peg and the surface being integral with the operating lever and the other with the supporting member, and the inclination of the surface being such that rotation of the operating lever varies the compression of the spring.

An example of a pressure reducing valve in accordance with the invention will now be described, with reference to the accompanying drawings in which:—

Figure 1 is a central vertical sectional elevation;

Figure 2 is a section on the line II—II of Figure 1, the connecting mouthpiece being omitted;

Figure 3 is a section on the line III—III of Figure 1 and Figure 2;

Figure 4 shows schematically operation of a device for controlling opening and closing of the valve;

Figure 5 shows schematically part of a safety device; and

Figures 6 and 7 show in plan and section respectively a locking ring.

The pressure reducing valve comprises a base 1, a body 2 and a cap 3.

The base 1 consists of a disc 4 which has on one surface a cavity closed by a flexible membrane 5 to form a first expansion chamber 6. On the opposite surface the disc 4 has an axial connecting socket 7 pierced laterally by two apertures 8 arranged face to face and each containing a ball 9 the diameter of which is greater than the thickness of the wall of the socket 7. Each aperture 8 is formed with a lip (not shown) to prevent a ball 9 from escaping into the inside of the socket. A boss 10 extends coaxially from the base of the socket 7. A bore 11 extends through the boss 10 and opens into the first chamber 6.

When assembled, the membrane 5 is locked between the base 1 and the body 2 by a screw 12 (Figure 1).

A central cavity 13 in the body 2 is open

[*Price* 4*s.* 6*d.*]

to the membrane 5 and extends into a cylindrical guide cavity 14 of smaller cross section. A cylindrical supporting member 15 slides in the cavity 14. The end of supporting member 15 situated in the cavity 13 has an outer flange 16 with two inclined and diametrically opposed faces 17 and 19, and directed towards the base of the cavities 13 and 14 (Figure 2). One or more ridges 19 (Figure 1) on the wall of the cavity 13 and situated in an axial plane of the cavity 14 engage in slots 20 in the flange 16 and prevent rotation of the supporting member 15.

A pushrod 21 integral with the central part of the first membrane 5 extends through the bore 11 with sufficient clearance to permit passage of gas at a rate corresponding to the nominal rate for which the reducing valve is designed. This pushrod 21 moves as one with a rod 22 the free end of which is guided in a hole in the top of the member 15.

The first membrane 5 is held between a nut 23 and a flange 24 of the rod 22. A compression spring 25 surrounding the rod 22 between the top of the member 15 and the flange 24.

A flat operating lever 26 (Figures 2 and 3) rotates about the cylindrical supporting member 15 as a pivot. This lever has two diametrically opposed pegs 27 and 28 (only the latter being seen in Figure 2) against which the inclined faces 17 and 18 are held by the spring 25. The lever 26 is angularly displaceable in a slot 29 in the body 2.

The inclination of the faces 17 and 18 is such that in one end position of the lever 26, that is the position shown in Figures 2 and 3, the pegs 27 and 28 hold the supporting member 15 in its position closest to the membrane 5 while compressing the spring 25, and in the other position the supporting member 15 extends to its maximum extent in the guide cavity 14 (Figure 1).

In the schematic view of Figure 4 showing a peg 28 co-operating with a sloping surface 18, the peg shown in full lines is in the position corresponding to that indicated in Figure 1 and the same peg shown in broken lines is in the position corresponding to that of Figures 2 and 3.

It will thus be seen that the position of the operating lever 26 shown in Figures 2 and 3 is the position for opening, since the increased compression of the spring 25 due to the decreased distance between the supporting member 15 and the flange 24 tends to move the end of the pushrod 21 outside the boss 10 (Figure 2) into contact with a closure member 49 of the valve 48 of the connecting mouthpiece 47 on which the pressure reducing valve is mounted (Figure 1), to open the valve 48.

On the other hand, the position of the operating lever 26 opposite to that shown in Figure 3 is the position of closure shown in Figure 1, in which the pushrod 21 is withdrawn into the boss 10 and cannot exert pressure on the closure member 49.

A compression spring 30 surrounding the pushrod 21 and bearing against a shoulder 31 in the bore 11 and against the nut 23 exerts on the membrane 5 a force contrary to that of the spring 25.

A passage 32 extends through a part of the disc 4, the first membrane 5 and the body 2 and opens by way of a valve seat 33 into a second expansion chamber 34.

An appliance to be operated is connected to the reducing valve by the outlet tube 35 which communicates with the second chamber 34.

As seen in Figure 2, a second flexible membrane 36 is anchored between the body 2 and the cap 3 by screws 37, and closes the second chamber 34. In this second chamber a lever 38 of the first order is pivoted on a fulcrum 39 fixed to the body 2. One arm of the lever has a valve closure 40 co-operating with the valve seat 33. The other arm ends in a fork 41 which engages a lug 42 fixed to the second membrane 36 and capable of pivoting the lever 38 in either direction. The connection between the fork 41 and the lug 42 has some play so that the second membrane 36 will not cause the valve 33, 40 to open unless the membrane has undergone a given amount of deformation.

Inside the cap 3, a compression spring 43 is mounted between two cups 44 and 45 one of which, together with the lug 42, is integral with the central part of the second membrane 36, while the other bears against the end of a screw 46 which is mounted in a correspondingly threaded aperture in the cap 3. By means of this screw, which is accessible from outside the cap, the spring 43 can be compressed to a greater or less extent, to modify the response of the second membrane 36 to the operating gas pressure in the second chamber 34. The screw 46 is embedded in an opening in the cap, the outer rim of which opening has a groove designed to receive a small cover which functions as a seal preventing access to the screw once the tension of the spring 43 has been adjusted.

In addition to the parts described, the pressure reducing valve also comprises safety devices which will now be described.

In Figure 1 the pressure reducing valve is shown mounted on the collecting mouthpiece 47 of a bottle of liquid gas (not shown). This mouthpiece has the valve 48 the axial closure member 49 of which is urged by a spring 50 in the direction of closure against its seat 51. The upper end of a rod 52 fixed to the closure member 49 is level with the upper end of the mouthpiece 47 and is opposite the free end of the pushrod 21.

A circular retaining groove 53 on the mouthpiece 47 fits accurately at the level of the balls 9 when the mouthpiece 57 is fitted between the boss 10 and the connecting socket 7.

A rotatable locking ring 54 surrounds the connecting socket 7 on which it is retained by an annulus 55 fitting in a circular groove on the socket 7 (Figure 2).

As shown in Figures 6 and 7, the locking ring has on its inner surface two cavities 56 consisting of grooves arranged diametrically opposite each other and parallel to the axis of the ring. Moreover, another cavity 57 forms a sloping surface 58 limited peripherally by abutments 59 and 60.

An axially extending locking rod 61 traverses the body 2, first membrane 5 and disc 4 and has one end extending into the cavity 57 of the ring 54. A spring 62 surrounding the rod and compressed between a shoulder 63 in the body 2 and a shoulder 64 on the rod holds the rod against the surface 58 of the ring 54 (Figure 2). In the position in which the rod 61 penetrates by the maximum amount the cavity 57 of the ring, the other end of the rod is flush with the seating of the operating lever 26. This seating is formed by the slot 29 (Figure 3). This is the position taken up by the rod 61 shown schematically in full lines in Figure 5. In the other position, the sloping surface 58 pushes the rod 61 into the slot 29. The rod 61 in this position is shown in broken lines in Figure 5.

The abutments 59 and 60 on either side of the surface 58 limit rotation of the ring 54, and at each end of the sloping surface a small cavity, in which the end of the rod 61 engages, holds the ring in one or other end position.

The operating lever 26 has a retaining aperture 65 (Figure 3) of a diameter greater than that of the rod 61 and arranged so that one end of the rod 61 can engage in this aperture when the lever is in the closing position. Moreover, the surface of the operating lever is sufficiently large to prevent the end of this rod 61 projecting through the slot 29 when the lever is in the open position (Figure 3).

The position of the cavities 56 relative to the sloping surface 58 and to the abutments 59 and 60 of the latter is such that the balls 9 can move back into these cavities 56 when the operating lever is in the closing position, and the ring 5 is rotated so that the surface 58 forces the rod 61 into the aperture 65. It is only when all these conditions are fulfilled that the connecting socket 7 can be fitted to the connecting mouthpiece 47 of the bottle by complete withdrawal of the balls 9 from the connecting socket.

The pressure reducing valve is operated as follows:—

When the conditions described above are fulfilled, that is to say when the operating lever 26 is in the closing position and the locking ring has been turned so that the rod 61 is engaged in the retaining aperture 65 of the lever and the apertures 8 of the socket 7 are opposite the cavities 56 of the ring, the connecting mouthpiece 47 of the bottle can be fitted between the lug 10 and the socket 7, thus causing the balls 9 to move back into the cavities 56. The balls are then in the position 9^1 shown in broken lines in Figure 6.

Owing to the fact that one of the ends of the locking ring 61 engages in the retaining aperture 65 of the operating lever 26, it is impossible to displace the latter so that it remains in the closed position. The other end of the rod then bears against the abutment 60.

The locking ring 54 may then be rotated so that the locking rod 61 is moved against the abutment 59 (Figure 5). The balls 9, moving out of the cavities 58 of the ring, are pushed by the inner wall of the latter into the circular grooves 53 of the connecting mouthpiece 47 and lock the pressure reducing valve to the latter. They then take up the position 9^2 shown in broken lines in Figure 6.

Moreover, one end of the locking rod 61 having followed the slope of the surface 58 due to the pressure exerted by the spring 62, the other end is withdrawn from the aperture 65 of the operating lever and has liberated the latter, which can then be pushed into the opening position.

It will be noted that if an attempt be made to fit the pressure reducing valve on to the mouthpiece while the operating lever 26 is in the open position, the latter would prevent displacement of the locking rod 61 owing to the fact that its upper end would abut against the lever and would prevent rotation of the locking ring held by the lower end of the rod which is locked in the small cavity of the sloping surface at the abutment 59 and consequently would prevent displacement of the balls 9 which alone permit introduction of the mouthpiece 47 into the socket 7.

When the operating lever 26 is pushed into the opening position, it increases the tension of the spring 25 due to sliding of the supporting member 15 produced by the action of the pegs 27 and 28 over the surfaces 17 and 18. Under the pressure exerted by the spring 25, the pushrod 21 overcomes the force of the springs 30 and 50, and depresses the control rod 52 which then moves the closure member 49 of the valve 48 from its seat. The compressed gas then flows through the bore 11 into the first chamber 6, through the passage 32, lifts the closure

member 40, enters the second chamber 34 and escapes through the outlet tube 35.

When a predetermined pressure, the amount of which depends on the choice of springs 25 and 30 and on the elastic resistance of the first membrane 5, is reached in the first chamber 6, this pressure acts on the first membrane 5 which makes the pushrod 21 move back into the boss 10, thus bringing about closure of the valve 48. The first chamber 6 and the valve 48 thus form an initial pressure limiting device.

The pressure prevailing in an appliance being operated, and consequently in the second chamber 34, is exerted on the second membrane 36 which is subject to deformation against the force of the spring 43 as soon as this pressure exceeds a given value. The membrane 36 then brings about closure of the valve 33, 40 by means of the lug 42 and the lever 38.

This second chamber 34 and its valve 33, 40 thus play the role of fine adjustment which is the more precise since the second membrane 36 is large and the lever 38 multiplies the action of the membrane 36 and of the pring 43.

To cut the supply of gas from the bottle, the operating lever 26 is moved into the closing position. The relaxed spring 25 thus enables the pushrod 21 to return into the boss 10 under the action of the spring 30, and the closure member 49 then bears against its seat 51.

When the operating lever 26 is in the closing position, its retaining aperture 65 is moved opposite the end of the locking rod 61. This position, which is the only one in which the rod 61 can move axially, is the condition required to enable the locking ring 54 to rotate and unlock the pressure reducing valve by moving the apertures 8 opposite the cavities 56.

The advantages of the pressure reducing valve according to the invention reside on the one hand in its simplicity of construction and its operating precision and on the other hand in the multiple safety device. In the latter in fact the locking device on the connecting mouthpiece cooperates with the operating lever 26 in such a way that the pressure reducing valve cannot be fitted to the mouthpiece or removed from it so long as the lever is not in the closing position, and cannot be pushed into the open position except when the locking operation has been carried out.

The connecting socket is provided with means to ensure a tight seal between the socket and the connecting mouthpiece.

WHAT WE CLAIM IS:—

1. A pressure reducing valve for liquid gas comprising a body, an outlet for expanded gas, and a connecting socket for fitting to a connecting mouthpiece for a liquid gas source, the mouthpiece having a valve with a closure member urged to the closed position; wherein a pushrod, axially movable in a bore in the socket with clearance to permit liquid gas flow, is fixed at one end to a first membrane closing a first expansion chamber, the length of the pushrod being such that on axial movement its free end can open the closure member of the mouthpiece valve; wherein a second expansion chamber communicates with the outlet and with the first chamber through a passage having a valve urged to closed position by a second membrane in the second chamber under the action of fluid expansion pressure; and wherein an operating lever, rotatably mounted about the axis of the push-rod, operates, by means of a peg and an associated inclined surface, an axially movable supporting member, a spring between the supporting member and the first membrane tending to move the pushrod into the mouthpiece and to move the peg and inclined surface relatively toward one another, one of the peg and the surface being integral with the operating lever and the other with the supporting member, and the inclination of the surface being such that rotation of the operating lever varies the compression of the spring.

2. A valve according to claim 1, wherein a second spring surrounds the pushrod and bears against a shoulder in the bore and also against the side of the first membrane facing the first chamber, the second spring being opposed to the first spring.

3. A valve according to claim 1 or claim 2, wherein the second membrane is urged into the second chamber by a third spring interposed outside the second chamber between the second membrane and a cup held against the spring in a cover fixed to the body, a screw accessible from outside the cover being engaged with the cup so that the tension exerted by the third spring can be regulated.

4. A valve according to any preceding claim, wherein a locking ring rotatable to either of two positions is mounted around the connecting socket in which is provided an orifice containing a ball of a diameter greater than the thickness of the socket wall and held in engagement by the inner wall of the ring in one position of the latter, namely its locking position, in a retaining housing provided on the connecting mouthpiece, which rotatable ring is provided on its inner wall with a cavity of depth sufficient to enable the ball to retreat into the cavity without projecting into the socket and into the connecting mouthpiece when the ring is in the other position, namely in the unlocking position, the ring having a sloping surface providing an abutment against which a fourth

spring presses one end of a second rod which is sufficiently long such that when the ring is in the unlocking position the other end projects into a slot in which the operating lever is displaceable, the operating lever having a retaining aperture of a diameter slightly greater than that of the second rod and arranged so that it is coaxial with the second rod when the operating lever is in the position corresponding to minimum compression of the first spring.

5. A valve according to claim 4, wherein the operating lever fills the part of the slot opposite the rod when the operating lever is in the position corresponding to maximum compression of the first spring.

6. A pressure reducing valve substantially as herein described, with reference to the accompanying drawings.

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1 SHEET This drawing is a reproduction of the Original on a reduced scale

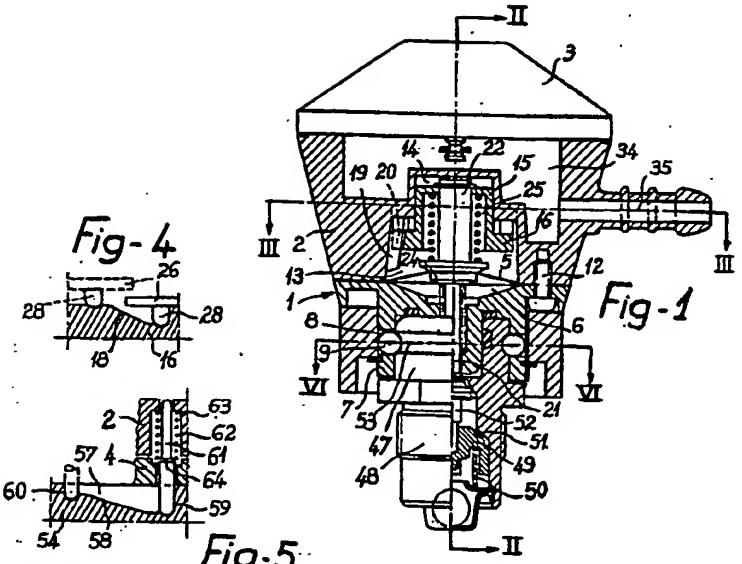

Fig-1

Fig-5

Fig-4

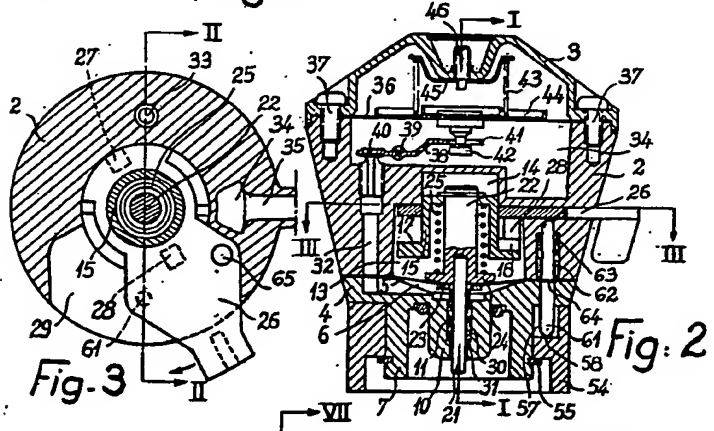

Fig-2

Fig-3

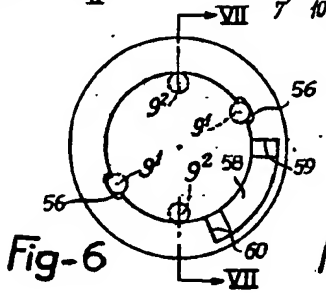

Fig-6

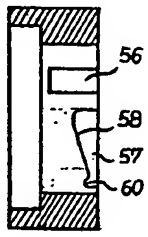

Fig-7